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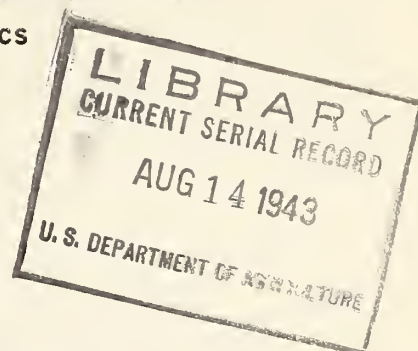
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UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Agricultural Economics



LABOR ASPECTS *of* MACHINE and HAND MILKING

by
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SOURCE OF MATERIAL

In February 1943, a selected list of crop correspondents furnished information concerning the number of cows milked per day on their farms with milking machines and by hand, the hours of labor required per day for milking with machine, and the number of hours that would have been required for milking the same cows by hand.¹ Information was also supplied concerning the average amount of work per day for cleaning and caring for their milking machines, the total days their machines were used in 1942, the average amount of service realized from the different kinds of rubber equipment of milking machines, methods of cleaning the machines, as well as information concerning kind, year of purchase and size of machines.

The data for this report were obtained by means of a mailed questionnaire which was returned by more than 1,750 farmers who owned milking machines. The material will be of use in determining the needs of farmers for milking machines during the war period.

¹In February 1943, questionnaires were sent to about 2,400 crop correspondents who had reported milking machines on their farms in the general farm machinery inquiry of February 1942. Findings of the 1942 study are summarized in the B. A. E. reports, F. M. 41, "Age and Size of Principal Farm Machines," and F. M. 42, "Work Performed With Principal Farm Machines."

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PRELIMINARY

Cows and heifers, 2 years old and over, kept for milk, now number approximately 27 million head--the largest number ever reported on United States farms. The farm labor force is the smallest in years and its effectiveness is further reduced as an unusually high proportion of the labor supply is made up of the young and the old workers. Dairying is a vital war industry and milking is an important job that must be performed on more than 4 million farms about twice each day.

The labor needed for performing the milking operation alone is tremendous in total. In 1943, an average of around 6 million hours of labor per day will be needed for milking cows, or a total of more than 2 billion hours for the year. Labor for milking amounts to about 10 percent of the total labor needed yearly for growing and harvesting all crops, for caring for all livestock, and for performing maintenance, repair, and miscellaneous farm work.

Demand for more milk production, with fewer farm workers, has resulted in an enormous demand for milking machines and for parts with which to fix up the older ones. Machines that were not used when labor was abundant and wages low have been brought out of storerooms and put into use. New rubber equipment and other vital parts were required for putting these machines in working order. Additional milker units are often desired as dairy herds are increased.

Many dairymen have had milking machines long enough to know pretty well what can be expected of them in the way of doing a good job of milking and of saving time. These experiences are especially useful today when greater production is demanded from a relatively small labor force.

ONE-HALF OF MILKING MACHINES ARE LESS THAN 4 YEARS OLD

Of the 310,000 milking machines (number of installations) estimated to be on farms January 1, 1943, about 45 percent were purchased in 1940, 1941 and 1942, and thus were 3 years or less of age. However, about 20 percent of the machines were 14 or more years of age (table 1).

Almost two-thirds of the milking machines are in the North Atlantic and the Lake States where sale of fluid milk is relatively important (table 2). There are more machines per 100 cows and heifers kept for milk, and per 100 dairy herds of 10 cows or more, in the North Atlantic States than in any other State group. These States had 85 milking machines (installations) for each 100 herds of 10 cows or more. As some of these machines are on farms with less than 10 cows, probably about 75 percent of the dairy farms in the North Atlantic States with 10 cows or more have milking machines.

MILKING MACHINES ARE POPULAR WITH FARMERS HAVING 10 OR MORE COWS

In February 1943, the average number of cows milked per herd on farms using milking machines was 20 head (table 7). This figure represents the number of cows actually milked by machine and by hand. Estimates from dairy correspondents show that in February 1943 the number of cows then being milked amounted to 72 percent of the total cows and heifers 2 years old and over kept for milk. This indicates that the average size of cow herd on farms using milking machines was about 27 head. Only 7 percent of the milking machines were on farms milking 8 cows or less and about 70 percent were on farms milking from 9 to 23 cows (table 3).

Although the number of cows milked tended to vary with the size of the machine used, there were wide variations in the size of cow herds milked with machines of the same size. For example, 3-cow machines were used with 8-cow herds and with 70-cow herds.

Differences in size of herd milked with a specific size of machine are probably due largely to changes in size of herd effected since the machine was purchased, and to seasonal variations in numbers of cows milked. In some areas, dairy production is known to be widely influenced by availability of feed supplies, especially pasture, with the result that the number of cows milked per herd varies widely in different periods of the year. The number is relatively low during the winter period and high during the spring and summer months.

On the farms using milking machines, about 95 percent of the cows were machine milked. Some of the cows milked by hand were animals not adapted to machine milking, some were "strippers" that required little milking, but on some farms substantial numbers of cows were milked by hand. On some of these farms the size of the milking machine was small in relation to the total number of cows milked.

Although the bulk of dairymen who used milking machines reported milking all their cows by machine, 35 percent of them also reported that some cows were hand milked. The tendency to milk part of the cows by hand was especially pronounced where large machines were used, and where the size of the cow herd was above average. In the North Atlantic States, a relatively high proportion of the farms where milking machines were used, reported some hand milking (tables 4 and 5).

ANNUAL USE OF MILKING MACHINES IS HIGH

Milking machines were used an average of 684 hours in 1941. This usage is greater than that of any other farm machine in common use. The farm tractor is used only about 500 hours per year on an average, and cream separators, large combines, and manure spreaders are used about 140 hours each. Most of the other farm machines are used even less. ^{2/}

Although only 88 percent of the milking machines on reporting farms were being used at the time of the survey (tables 4 and 5), the number of machines not used in 1942 amounted to only 4 percent of the total (table 6). On 75 percent of the reporting farms, the milking machines were used every day in 1942, 21 percent used their machines less than 365 days. Idle machines in February were relatively important on farms with 1-cow milkers. Also, in the Great Plains, machines not in use in February 1943 were high in number compared with the other State groups.

MILKING MACHINES IMPORTANT LABOR SAVERS

For all sizes of cow herds and for all sizes of machines reported on, a saving of about 2 1/3 hours of labor per day of use was effected by the use of milking machines (table 7).

Farm-to-farm variations in the labor saving thus effected are wide and, according to this study, are about in proportion to the size of the cow herd. In other words, with the same size machine, labor savings over hand milking were from 300 to 700 percent more for the large herds than for the small herds (table 8). Fewer cows were milked per hour of labor with 1-cow machines than with other sizes. The amount of labor used per cow for machine milking did not vary significantly with other sizes of milking machines.

If the milking machines now on farms are used 88 percent of the time to milk cow herds of the size indicated by the survey, somewhat more than 25 percent of the dairy cows will be machine milked in 1943. With

^{2/} "Work Performed With Principal Farm Machines." F.M. 42, Bureau of Agricultural Economics, U.S.D.A. Mimeographed.

the present number of milking machines, labor needs on dairy farms in 1943 will be about 210,000,000 hours less than would be required if there were no machines. This saving in labor assumes that milking machines will be used an average of 320 days during the year and will effect a saving of about 2 1/3 hours of labor per day of use. The 210,000,000 hours of labor saved annually amounts to about 1 percent of the total yearly labor needed for all farm work, and is equivalent to the amount of labor that would be contributed by about 70,000 workers each working 3,000 hours per year.

HAND MILKING REQUIRES SKILL—STRENGTH

Hand milking requires skill that comes from proper training and experience; strong wrists and fingers are essential. Variations in these essentials, and the fact that some cows are harder to milk than others, partly explain the wide range in the reports of farmers on number of cows milked per hour by hand.

Of the 1,541 herds reported on, 65 percent were estimated to require 1 hour to milk 6 to 9 cows by hand. In 19 percent of the cases, less than 6 cows were milked per hour whereas, at the other extreme, 16 percent of the reports indicated that 9 or more cows could be milked by hand in one hour (table 9).

According to the survey, cows in the larger herds are milked more rapidly than those in the smaller herds. Generalized results from the survey relative to the effect of size of herd on labor for milking by hand are as follows:

<u>In herds of</u>	<u>Cows milked in one hour by hand</u>
Less than 10 cows	6.4
11 to 20 cows	6.9
21 and more cows	7.1

The present shortage of skilled dairy workers has resulted in a greater demand for milking machines. The hour or two saved per day by use of the milking machine is valuable to the small dairyman who does practically all of his dairy and field work without hired labor, and the 5 to 10 hours saved daily by the larger dairyman, who must depend on hired workers may be the deciding factor in maintaining his business. This is especially important to those who must make greater use of women and older workers in the dairy.

The findings of this study indicate that, in general, if the total size of the cow herd is less than 10, savings in labor effected by using milking machines would not be sufficient to offset the costs involved in operating a machine.

However, on some farms considerations other than expense may well be important. Hand milking requires considerable strength and experience is necessary to do a good job. With relatively aged or inexperienced labor, machine milking may be necessary if the job is to be done, even though relatively high costs for milking are incurred.

CLEANING MILKING MACHINES

Sanitation is of first importance in the operation of milking machines. Lack of care of "milkers" has been directly responsible for many machines going out of use. Many States, as well as Federal agencies, have recognized the importance of sanitation and have developed definite methods for cleaning milking machines.

In the present study, information was obtained on the frequency of using hot water, temperature of the water used, and the extent of use of chemical solution in the cleaning of milking machines.

About two-thirds of the farms reported using chemicals, either with lukewarm or hot water, in caring for machines and the remainder used hot water alone. Of the farms using hot water, more than half used hot water two or more times a day and most of the remaining farms used hot water once a day. A few farms reported the use of hot water less frequently than once a day.

Use of chemicals for cleaning machines was reported by dairymen in all States, but a little less frequently in the Pacific States than in the other State groups. Temperature of the water used varied from about 120° F. to over 200° F., with about 160° F. the average for all farms. Most farmers who reported low water temperatures used chemicals also. However, some farmers who did not use chemicals, reported water temperatures that were too low to destroy bacteria effectively.

RUBBER NEEDS FOR OPERATING MILKING MACHINES

The increased use of milking machines means increased employment of skilled nonfarm labor in their manufacture, and increased use of steel, tin, rubber, and other scarce materials for producing and servicing them.

To service the machines now on farms requires about 800 tons of crude rubber each year. Under normal conditions this figure is small compared with the total consumption of rubber. Today rubber is scarce and every means for making maximum use of the limited supplies are desirable.

The usual life of teat cup liners is much less than that of other equipment, averaging about one-half year for all farms (table 10). The average life of small or short tubing is estimated at 65 weeks; large or long tubing, 73 weeks; and for stanchion hose, more than 5 years (tables 11, 12, and 13).

The service obtained from each kind of rubber equipment varies widely on different farms. Some of these variations, especially for teat cup liners and short tubing, are due in part to differences in amount of annual use. Farmers reporting the shortest life for rubber equipment milked more cows per machine per day than did farmers with longer lived rubber equipment. But the additional use was not sufficient to account for the decrease in life of the rubber equipment.

Probably of much greater importance were the differences in quality of rubber equipment with which the various machines were supplied. Unless the rubber equipment is thoroughly rinsed and cleaned of fat, the use of hot water for sterilization shortens its life. When chemicals are used for cleaning rubber equipment the amount of service obtained is greater than when the hot-water method is used.

Some dairymen doubtless discard their rubber equipment when it is still serviceable, whereas others keep their equipment in use, even after it should be discarded. Life of rubber equipment was materially below average in the Southern States and above average in the Lake States.

Table 1.- Number and age distribution of milking machines on farms
United States, January 1, 1943

Number of milking machines on farms Jan. 1, 1943 1/	Number of machines of specified ages 2/					
	3 years	4-8	9-13	14-18	19-23	24 years
	and	years	years	years	years	and
	less	:	:	:	:	over
	Percent	Percent	Percent	Percent	Percent	Percent
310,000	46	23	10	13	5	3

1/ Estimated number of installations.

2/ Machines 3 years old and less, 1940-42 purchases; 4 to 8-year machines, 1935-39 purchases; 9 to 13-year machines, 1930-34 purchases; 14 to 18-year machines, 1925-29 purchases; 19-23 machines, 1920-24 purchases; and machines 24 years old and older purchases of 1919 and earlier years.

Table 2.- Number of milking machines per 100 cows and heifers, 2 years.
old and over kept for milk, and per 100 herds of 10 or more
cows, State groups, January 1, 1943

State group 1/	Cows and heifers kept for milk Jan. 1, 1943		Milking machines on farms, Jan. 1, 1943 2/		Machines per 100 cows and heifers kept for milk Jan. 1, 1943		Farm herds with 10 or more milk cows Jan. 1, 1943 3/		Milking machines per 100 herds of 10 cows or more	
	Thousands	Thousands	Thousands	Thousands	Number	Number	Thousands	Thousands	Number	Number
North Atlantic	3,258	98.0			3.01		115		85	
Corn Belt	5,658	54.5			.96		126		43	
Lake States	5,305	102.9			1.94		219		47	
Great Plains	2,672	8.8			.33		59		15	
Mountain	1,023	8.3			.81		20		41	
Pacific Coast	1,457	25.7			1.76		33		78	
Other	7,573	11.8			.16		75		16	
United States	26,946	310.0			1.15		647		48	

1/ North Atlantic includes the New England States and New Jersey, New York, and Pennsylvania. Corn Belt includes Ohio, Indiana, Illinois, Iowa, and Missouri. Lake States include Michigan, Wisconsin, and Minnesota. Great Plains include North Dakota, South Dakota, Nebraska and Kansas. Mountain includes Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, and Nevada. Pacific includes Washington, Oregon, and California. Other includes Delaware, Maryland, West Virginia, Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Louisiana, Arkansas, Oklahoma, and Texas.

2/ Number of installations.

3/ Estimates based largely on information published for 1939 by Bureau of the Census and include dry cows, heifers 2 years old and over, not yet freshened, in addition to cows being milked.

Table 3.- Size of cow herd milked with machines of specified size,
United States, February 1943

United States, February 1940

Cows milked per herd 1/	Percentage of herds of specified size reporting use of					
	1-cow machine	2-cow machine	3-cow machine	4-cow machine	5-cow machine: and over:	All sizes
	Percent	Percent	Percent	Percent	Percent	Percent
8 and less	27	6	1	1	---	7
9-13	53	28	5	8	---	25
14-18	15	33	16	20	4	28
19-23	4	19	19	19	11	17
24-28	1	7	20	13	4	9
29-38	---	4	18	18	11	6
39-48	---	2	15	6	11	4
49-58	---	1	1	4	---	1
59-68	---	2/	3	3	11	1
69 and over	---	2/	2	8	43	2

1/ Number of cows milked with machines and by hand on farms using milking machines, February 1943. The total size of the cow herd including dry cows and heifers 2 years old and over, not yet freshened, was on an average of about 40 percent greater than the size of the cow herd being milked in February 1943, when according to reports from dairy correspondents only 72 percent of the total herd was being milked.

2/ Less than one-half of 1 percent.

Table 4.- Herds that were milked by machine alone, by machine and hand,
and by hand alone, on farms where milking machines were owned,
State groups, February 1943

State group 1/	Dairy farms reporting milking machines	Percentage of herds, Feb. 1943, that were			
		Machine milked	Machine and hand milked 3/	Milked by hand	
	Number	Percent	Percent	Percent	
North -Atlantic	466	48	41	11	
Corn Belt	313	54	34	12	
Lake States	547	52	37	11	
Great Plains	74	56	20	24	
Mountain	105	59	29	12	
Pacific Coast	171	65	24	11	
Other	77	54	38	8	
All herds	1,753	53	35	12	

1/ See footnote 1, table 2.

2/ Cows stripped after the machines were classed as machine milked.

3/ Part of the cows in the herd were milked on the same day by machine and part by hand.

Table 5.- Herds that were milked by machine alone, by machine and by hand, and by hand alone, on farms where milking machines were owned, by size of milking machine, February 1943

Size of machine (equivalent single units)	Percentage of herds, February 1943, that were			
	Dairy farms:		Machine	
	reporting		and	
	milking		hand	
	machines	Machine	milked	by
		1/	milked 2/	hand
	Number	Percent	Percent	Percent
One	187	44	35	21
Two	1,190	56	33	11
Three	187	54	38	8
Four	162	50	39	11
Five and more	27	34	66	0
All herds	1,753	53	35	12

1/ See footnote 2, table 4.

2/ See footnote 3, table 4.

Table 6.-Milking machines distributed according to days used, by size of machine, 1942

Size of machine (equivalent single units)	Percentage of machines in 1942 that were			
	Average		Used	
	days used		183 to	
	in 1942		365	
	Not	less than	182 days	365
	used	182 days	364 days	days
	Number	Percent	Percent	Percent
One	300	6	9	66
Two	320	4	3	75
Three	335	4	1	80
Four	335	2	3	79
Five and more	362	-	-	97
All sizes	320	4	3	75

Table 7.- Labor used per day for milking cows with milking machines and by hand, State groups,
February 1943 ^{1/}

State group ^{2/}	Average size of milking machine on reporting farms (equivalent to single units)	Cows milked per herd (machine and hand) ^{3/}	Labor required per herd per day				Labor saved			
			Cows milked per herd with machine	For milking with machine	For cleaning milking machine	Total for machine milking	For milking by hand	For milking by machine	per herd per day	by milking machine
	Number	Number	Number	Hours	Hours	Hours	Hours	Hours	Hours	Hours
North Atlantic	2.4	22.0	20.3	2.91	0.49	3.40	5.96	2.56		
Corn Belt	2.1	16.1	15.0	2.20	.41	2.61	4.44	1.83		
Lake States	2.2	16.9	15.7	2.15	.36	2.51	4.47	1.96		
Great Plains	2.3	17.7	17.1	2.45	.41	2.86	5.10	2.24		
Mountain	2.0	19.2	18.5	2.63	.48	3.11	5.22	2.11		
Pacific Coast	2.2	26.5	25.6	3.72	.53	4.25	7.42	3.17		
Other	2.6	34.5	32.1	4.02	.58	4.60	8.49	3.89		
United States	2.3	20.0	18.7	2.64	.44	3.08	5.40	2.32		

^{1/} Farmers were asked in February 1943 to set down the number of cows milked "yesterday" by machine and by hand, and the time required for machine milking and what time would have been required to milk the same cows by hand.

^{2/} See footnote 1, table 2.

^{3/} In February 1943 for the entire country only 72 percent of the cows and heifers 2 years old and over kept for milk were actually being milked. Thus the average size of herd for the United States was about 27 head.

Table 8.- Labor used per day for milking cows by machine and by hand and the savings in labor effected by using milking machine, by size of milking machine and by size of herd, February 1943

Size of herd (number of cows)	Cows milked per herd per day		Labor required per herd per day for				
	Average	With machine	Milking with machine	Cleaning	Total	Milking	Labor
				and	for	by	saved
				caring	for	hand	per day
			milking	milking		by	by
			machine	machine		milking	milking
			machine	machine		machine	machine
	Number	Number	Hours	Hours	Hours	Hours	Hours
1-cow machine 1/							
8 and less	6.6	6.3	1.24	.30	1.54	2.15	.61
9 to 13	10.9	9.8	1.79	.30	2.09	3.21	1.12
14 to 18	14.8	12.7	2.34	.28	2.62	4.17	1.55
19 and over	21.0	16.3	2.86	.30	3.19	4.86	1.67
All herds	10.8	9.6	1.77	.30	2.07	3.15	1.08
2-cow machine 1/							
8 and less	6.0	6.6	1.02	.33	1.35	1.98	.63
9 to 13	11.2	10.6	1.60	.37	1.97	3.18	1.21
14 to 18	16.0	15.1	2.19	.42	2.61	4.35	1.74
19 to 23	20.7	19.4	2.62	.43	3.05	5.42	2.37
24 to 28	25.4	23.5	3.06	.53	3.59	6.11	2.52
29 and over	38.1	34.5	4.65	.58	5.23	9.75	4.52
All herds	17.1	15.9	2.25	.42	2.67	4.55	1.88
3-cow machine 1/							
13 and less	10.9	10.2	1.65	.31	1.96	2.98	1.02
14 to 18	16.1	15.3	2.07	.35	2.42	4.52	2.10
19 to 23	21.0	19.9	2.53	.42	2.95	5.58	2.63
24 to 28	26.3	25.0	3.42	.55	3.97	7.42	3.45
29 to 38	34.0	32.9	4.32	.66	4.98	9.02	4.04
39 to 48	42.7	39.8	4.61	.54	5.15	10.64	5.49
49 and over	68.7	64.5	8.50	.89	9.39	16.91	7.52
All herds	29.2	27.7	3.59	.52	4.11	7.71	3.60
4-cow machine 1/							
13 and less	11.3	10.6	1.39	.42	1.81	3.04	1.23
14 to 18	16.5	15.7	2.39	.38	2.77	4.94	2.17
19 to 23	20.7	19.7	2.81	.47	3.28	5.83	2.55
24 to 28	25.9	24.9	3.42	.47	3.89	6.53	2.64
29 to 38	31.9	29.5	3.96	.55	4.51	8.81	4.30
39 to 48	42.0	41.2	5.11	.72	5.83	11.89	6.06
49 and over	75.9	70.0	10.24	.82	11.06	22.00	10.94
All herds	30.9	29.1	4.09	.53	4.62	8.73	4.11
5 and 6-cow machines 1/							
All herds	50.8	47.1	5.86	.84	6.70	13.89	7.19
7 and more cow machines 1/							
All herds	114.5	105.9	16.19	1.09	17.28	30.75	13.47

1/ Number of cows that can be milked at one time with machine.

Table 9.- Range in estimates of number of cows milked per hour by hand, February 1943

Cows milked per hour by hand		Dairy farms reporting specified number of cows milked per hour	
		Number	Percent
Less than 5		103	7
5 - 5.9		191	12
6 - 6.9		424	27
7 - 7.9		262	17
8 - 8.9		323	21
9 - 9.9		121	8
10 and more		117	8
Total		1,541	100

Table 10.- Service obtained from teat cup liners, State groups, February 1943

State group <u>1/</u>	Average		Percentage of farms reporting use of			
	life of	teat cup liners	13 weeks and less	14 to 26 weeks	27 to 40 weeks	41 weeks and more
	Weeks	Percent	Percent	Percent	Percent	Percent
North Atlantic	26	20	48	20	12	
Corn Belt	28	13	47	25	15	
Lake States	31	12	37	25	26	
Great Plains	30	18	40	22	20	
Mountain	25	20	53	16	11	
Pacific	20	34	45	16	5	
Other	17	52	35	9	4	
United States	27	19	43	22	16	

1/ See footnote 1, table 2.

Table 11.- Service obtained from short rubber air tubing, State groups, February 1943

State group <u>1/</u>	Average		Percentage of farms reporting use of			
	life of	tubing	26 weeks and less	27 to 52 weeks	53 to 78 weeks	79 weeks and more
	Weeks	Percent	Percent	Percent	Percent	Percent
North Atlantic	60	13	58	9	20	
Corn Belt	65	13	45	13	29	
Lake States	73	9	43	15	33	
Great Plains	67	22	37	6	35	
Mountain	59	21	45	11	23	
Pacific	59	26	43	8	23	
Other	51	38	39	7	16	
United States	65	15	47	11	27	

1/ See footnote 1, table 2.

Table 12.- Service obtained from long rubber tubing, State Groups, February 1943

State group 1/	Average life of tubing	Percentage of farms reporting use of			
		26 weeks and less	27 to 52 weeks	53 to 78 weeks	79 weeks and more
	Weeks	Percent	Percent	Percent	Percent
North Atlantic	66	12	51	9	28
Corn Belt	75	10	38	10	42
Lake States	82	4	35	15	46
Great Plains	76	7	43	7	43
Mountain	69	12	46	8	34
Pacific	64	23	43	9	25
Other	61	28	39	7	26
United States	73	11	42	11	36

1/ See footnote 1, table 2.

Table 13.- Service obtained from stanchion hose, State groups, February 1943

State group 1/	Average life of stanchion hose	Percentage of farms reporting use of			
		3 years and less	4 to 6 years	7 to 9 years	10 years and over
	Years	Percent	Percent	Percent	Percent
North Atlantic	5.2	41	34	7	18
Corn Belt	5.3	37	37	12	14
Lake States	5.5	36	38	8	16
Great Plains	5.0	46	33	6	15
Mountain	4.8	42	40	8	10
Pacific	4.8	40	41	8	11
Other	4.1	48	48	2	2
United States	5.2	39	37	8	16

1/ See footnote 1, table 2.

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